

## CLAIMS

1. A method for programmably scrambling a multidimensional digital frame structure, the method comprising:
- 5 generating a selectable scrambling algorithm; and  
scrambling communications using the selectable scrambling algorithm.
2. The method of claim 1 further comprising:
- 10 defining a scrambling structure;  
selectively seeding the scrambling structure; and  
wherein generating a selectable scrambling algorithm includes generating a selectable scrambling algorithm from the selectively seeded scrambling structure.
- 15 3. The method of claim 2 wherein selectively seeding the scrambling structure includes selectively initializing the scrambling structure with a seed mask.
- 20 4. The method of claim 3 further comprising:  
forming superframes from a first plurality of frames; and  
wherein selectively seeding the scrambling structure includes selecting a seed mask every superframe.

5. The method of claim 4 wherein selectively seeding the scrambling structure includes selecting a seed mask from a second plurality of seed masks; and

wherein scrambling communications using the selectable scrambling algorithm includes scrambling the communications with a second plurality of scrambling algorithms.

6. The method of claim 5 wherein defining a scrambling structure includes defining a scrambling structure with a third plurality of steps; and

wherein selectively seeding the scrambling structure includes forming seed masks including a third plurality of bits.

7. The method of claim 6 wherein forming superframes from a first plurality of frames includes forming superframes having frame synchronization bytes; and

wherein scrambling communications using a selectable scrambling algorithm includes synchronously scrambling the communications in each superframe in response to the superframe frame synchronization bytes.

8. The method of claim 6 in which the third plurality equals 16.

9. The method of claim 3 wherein selectively seeding the scrambling structure includes generating seed masks in response to a predetermined seed mask selection algorithm.

5 10. The method of claim 1 further comprising:  
transmitted the scrambled communications;  
receiving the scrambled communications;  
defining a descrambling structure;  
selectively seeding the descrambling structure; and  
10 descrambling communications using a descrambling  
algorithm responsive to the selectively seeded descrambling structure.

11. The method of claim 10 wherein selectively seeding  
the scrambling structure includes seeding the scrambling structure with a  
15 first seed mask; and  
wherein selectively seeding the descrambling structure  
including seeding the descrambling structure with the first seed mask.

12. The method of claim 11 further comprising:  
20 receiving seed mask information in an auxiliary channel;  
and  
selecting seed masks in response to the receiving seed mask  
information; and  
wherein selectively seeding the descrambling structure  
25 includes seeding the descrambling structure with the seed masks selected  
in response to the seed mask information.

13. The method of claim 12 wherein receiving seed mask information in an auxiliary channel includes receiving unscrambled overhead bytes; and

5 wherein selecting seed masks in response to the receiving seed mask information includes selecting seed masks in response to receiving the unscrambled overhead bytes.

10 14. The method of claim 13 further comprising:  
establishing a seed mask generation key; and  
wherein selecting seed masks in response to the receiving seed mask information includes using the unscrambled overhead bytes as a key to generate the seed masks.

15 15. The method of claim 13 further comprising:  
storing seed masks; and  
wherein selecting seed masks in response to receiving the unscrambled overhead bytes includes using the unscrambled overhead bytes as a key to retrieve the seed masks.

20 16. The method of claim 13 wherein receiving seed mask information in an auxiliary channel includes receiving unscrambled frame synchronization bytes.

25 17. The method of claim 13 wherein the scrambled communications are received through a first data link; and

wherein receiving seed mask information in an auxiliary channel includes receiving seed mask information through a second data link.

5                   18.    The method of claim 13 wherein receiving scrambled communications includes receiving scrambled communication superframes; and

                  wherein selectively seeding the descrambling structure includes selecting a seed mask every superframe.

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                  19.    A method for programmably descrambling a multidimensional digital frame structure, the method comprising:

                  receiving scrambled communications;

                  defining a descrambling structure;

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                  selectively seeding the descrambling structure

                  generating a selectable descrambling algorithm responsive to the selective seeding of the descrambling structure; and

                  descrambling the communications using the selectable descrambling algorithm.

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                  20.    The method of claim 19 wherein selectively seeding the descrambling structure includes periodically changing the descrambling structure seed mask.

21. The method of claim 20 wherein receiving scrambled communications includes receiving scrambled communication superframes; and

wherein selectively seeding the descrambling structure  
5 includes selecting a seed mask every superframe.

22. The method of claim 21 wherein receiving scrambled communications includes receiving scrambled communication superframes, with each superframe including frame synchronization  
10 bytes; and

wherein descrambling communications using a selectable descrambling algorithm includes synchronously descrambling the communications in each superframe in response to the superframe frame synchronization bytes.  
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23. The method of claim 22 further comprising:  
receiving seed mask information in an auxiliary channel;  
and  
selecting seed masks in response to the receiving seed mask  
20 information; and

wherein selectively seeding the descrambling structure including seeding the descrambling structure with the selected seed masks.

24. The method of claim 23 wherein receiving seed mask information in an auxiliary channel includes receiving unscrambled overhead bytes; and

wherein selecting seed masks in response to the receiving  
5 seed mask information includes selecting seed masks in response to receiving the unscrambled overhead bytes.

25. The method of claim 24 further comprising:  
establishing a seed mask generation key; and

10 wherein selecting seed masks in response to the receiving seed mask information includes using the unscrambled overhead bytes as a key to generate the seed masks.

26. The method of claim 24 further comprising:

15 storing seed masks; and

wherein selecting seed masks in response to receiving the unscrambled overhead bytes includes using the unscrambled overhead bytes as a key to retrieve the seed masks.

20 27. A system for programmably scrambling a multidimensional digital frame structure, the system comprising:

a transmitter including:

a scrambling algorithm generator having an  
input to accept a seed mask and an output to supply a scrambling  
25 algorithm responsive to the structure of the algorithm generator  
and the seed mask;

a transmit seed mask generator having a first input to accept seed selection commands and an output connected to the scrambling algorithm generator input to selectively supply seed masks;

5 a scrambler having a first input to accept communications and a second input connected to the scrambling algorithm generator output, the scrambler having an output to supply communications scrambled with the scrambling algorithm responsive to the selected seed mask.

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28. The system of claim 27 wherein the transmit seed mask generator periodically receives commands to change the seed mask.

29. The system of claim 28 wherein the scrambler accepts  
15 communications formatted in superframes, with each superframe including a first plurality of frames;

wherein the transmit seed generator selects a seed mask every superframe; and

wherein the scrambling algorithm generator changes the  
20 scrambling algorithm every superframe.

30. The system of claim 28 wherein the scrambler accepts communications formatted in superframes, with each superframe including frame synchronization bytes; and



wherein the scrambler synchronously scrambles the communications in each superframe in response to the superframe frame synchronization bytes.

5                   31.    The system of claim 30 further comprising:

                  a receiver including:

                                  a descrambling algorithm generator having an  
input to accept a seed mask and an output to supply a descrambling  
algorithm responsive to the structure of the algorithm generator  
10                   and the seed mask;

                                  a receiver seed mask generator having a first  
input to accept seed selection commands and an output connected  
to the descrambling algorithm generator input to selectively supply  
seed masks; and

15                                a descrambler having a first input to accept  
scrambled communications and a second input connected to the  
descrambling algorithm generator output, the descrambler having  
an output to supply communications descrambled with the  
descrambling algorithm responsive to the selected seed mask.

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                  32.    The system of claim 31 wherein the transmit seed  
generator accepts commands to generate a first seed mask;

                                  wherein the scrambling algorithm generator generates a first  
algorithm in response to receiving the first seed mask;

25                                wherein the scrambler scrambles communications using the  
first algorithm;

wherein the receiver seed generator accepts commands to generate a first seed mask;

wherein the descrambling algorithm generator generates a first algorithm in response to receiving the first seed mask; and

5 wherein the descrambler descrambles communications using the first algorithm.

33. The system of claim 32 wherein the receiver accepts seed mask information in an auxiliary channel and supplies seed mask commands to the receiver seed mask generator in response to the seed mask information; and

wherein the receiver seed mask generator generates a first seed masks in response to the received seed mask information;

15 wherein the descrambling algorithm generator generates a first algorithm in response to the first seed mask; and

wherein the descrambler descrambles the communications in response to the first algorithm.

34. The system of claim 33 wherein the receiver receives seed mask information in an auxiliary channel as unscrambled overhead bytes; and

wherein the receiver seed generator generates the first seed mask in response to the receipt of the unscrambled overhead bytes.

35. The system of claim 33 wherein the receiver receives seed mask information in an auxiliary channel as unscrambled overhead bytes; and

wherein the receiver seed generator retrieves a seed mask  
5 from storage in response to the receipt of the unscrambled overhead bytes.

36. The system of claim 33 wherein the receiver receives seed mask information in an auxiliary channel as unscrambled frame synchronization bytes.

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37. The system of claim 33 wherein the receiver accepts scrambled communications through a first data link and the auxiliary channel through a second data link, independent of the first data link.

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38. The system of claim 33 wherein descrambler receives scrambled communication formatted into superframes; and

wherein the receiver seed generator accepts commands to generate a new seed mask every superframe.

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39. In a multidimensional digital frame structure, a method for segmenting nodes in a network of communication nodes, the method comprising:

scrambling a communication;

communicating the descrambling key to selected nodes in the

25 network; and

descrambling the communication at the selected nodes, in response to receiving the descrambling key.

40. The method of claim 39 further comprising:

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selecting a first seed mask;

generating a first scrambling algorithm from the first seed mask; and

wherein scrambling a communication includes scrambling the communication using the first scrambling algorithm.

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41. The method of claim 40 further comprising:

receiving the descrambling key at the selected nodes;

in response to receiving the descrambling key, generating the first seed mask;

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generating a first descrambling algorithm from the first seed mask; and

wherein descrambling the communication at the selected nodes in response to receiving the descrambling key includes descrambling the communication using the first descrambling algorithm.

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